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ABSTRACT

This study examined the comparative impact of two generations of a computer-assisted career guidance system, System of Interactive Guidance and Information (SIGI), and SIGI PLUS, on the career decidedness, vocational identity, and user perceptions of 64 college students. The students were randomly assigned to either SIGI or SIGI PLUS. The Occupational Alternatives Question, and My Vocational Situation were completed during pre- and post-treatment while the SIGI or SIGI PLUS Evaluation Form (a measure of user perceptions) was completed during post-treatment. After the completion of initial post-testing, students used the second system and completed the Comparative Computer Rating Form. Users rated SIGI and SIGI PLUS equally positive for their effectiveness in obtaining self and occupational information (analysis), viable career options (synthesis), and in attractiveness of interaction with the computer (computer effect). Persons with initial information needs rated both CACG systems significantly higher on the analysis scale than users without needs for information. Students' level of vocational identity increased significantly as a result of using SIGI and SIGI PLUS. Students with low initial vocational identity were more likely to increase their vocational identity if they used SIGI PLUS, than if they used SIGI. SIGI and SIGI PLUS appear equally capable of satisfying users' needs for information. When the students were asked to indicate their overall preference for one of the two systems, 38 percent preferred SIGI, while 62 percent preferred SIGI PLUS. The survey instrument and 53 references are attached. (Author/LLL)

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# A Comparative Analysis of the Impact of Two Generations of a Computer-Assisted Career Guidance System - SIGI and SIGI PLUS: Technical Report No. 7

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**Abstract**

A study was conducted to examine the comparative impact of two generations of a computer-assisted career guidance system, SIGI and SIGI PLUS, on the career decidedness, vocational identity, and user perceptions of 64 college students. Students from an introductory psychology class who expressed interest in an experiment that involved receiving career guidance services were randomly assigned to either SIGI or SIGI PLUS. The Occupational Alternatives Question, and My Vocational Situation were completed pre- and post-treatment while the SIGI or SIGI PLUS Evaluation Form (a measure of user perceptions) was completed post-treatment. After the completion of initial post-testing, students then used the second system and completed the Comparative Computer Rating Form which involved a direct bipolar comparison of the two systems. A series of multivariate and univariate statistical analyses revealed that users rated SIGI and SIGI PLUS equally positive for their effectiveness in obtaining self and occupational information (Analysis), viable career options (Synthesis), and in attractiveness of interaction with the computer (Computer Effect). Persons with initial information needs rated both CACG systems significantly higher ($p < .05$) on the Analysis scale than users without needs for information. Students' level of vocational identity increased significantly ($p=.006$) as a result of using SIGI and SIGI PLUS. Students with low initial vocational identity were more likely to increase their vocational identity if they used SIGI PLUS, than if they used SIGI. SIGI and SIGI PLUS appear equally capable of satisfying users' needs for information. Finally, when the 63 students were asked to indicate their overall preference for one of the two CACGS used, 24 or 38% preferred SIGI, while 39 or 62% preferred SIGI PLUS. Discussion of these results explored the differential impact of SIGI and SIGI PLUS and the equivalence of CACG systems. Specific implications for practice, system development, and future research are also provided.

## Background

Computer-assisted career guidance (CACG) and information systems have become a common resource in the provision of career counseling and guidance services (Chapman & Katz, 1983; McKinlay, 1988; Sampson, Shahnasarian, & Reardon, 1987). Numerous studies have been conducted to determine software effectiveness within the context of various individual, group, and curricular-based intervention strategies (Cairo, 1983; Clyde, 1979; Parish, Rosenberg, & Wilkinson, 1979; Sampson, 1984). These data have been used by practitioners to select software, by system developers to refine computer applications and develop new software, and by researchers as a basis for conducting future research.

The rapid rate of software development, due partly to the ease with which software can be modified and the rapid changes in hardware capabilities and costs, has created an unprecedented problem for practitioners, system developers, and researchers. Traditional career guidance resources, e.g. assessment instruments, work sample kits, monographs, etc., were revised relatively infrequently due to the high cost of validating, manufacturing, and shipping new materials. Because software is leased on a yearly basis (and therefore replaced) and the cost of manufacturing and shipping computer disks is relatively low, revised or entirely new versions of existing software are produced more frequently. Most of the widely-used CACG systems, including CHOICES, CIS, DISCOVER, GIS, and SIGI PLUS, have evolved significantly from their initial production versions. While this capacity for relatively rapid change and anticipated improvement is an important advantage of computer software, problems can arise when an attempt is made to generalize across versions of a particular system or generalize about a particular system's performance over time. Major CACG system changes could in fact lessen a system's effectiveness, while professionals would continue to assume that prior research data was still valid. What is needed is a methodology for studying evolving versions of CACG systems so that: 1) professionals can have some preliminary ideas as to how a specific version of a CACG system will impact the career behavior of clients; and 2) developers and researchers can understand more about comparative effects.

A case in point involves the System of Interactive Guidance and Information (SIGI) and SIGI PLUS. The original SIGI system was designed at the Educational Testing Service under the leadership of Martin Katz, with development beginning in 1971 and the first production version released in 1976. SIGI was designed to help students clarify their values, identify and explore occupational alternatives, receive and interpret relevant occupational and educational data, and master strategies for making informed and rational career decisions (Katz, 1973, 1980). The five SIGI subsystems include: 1) VALUES, 2) LOCATE, 3) COMPARE, 4) PLANNING, and 5) STRATEGY. A variety of theoretical (Katz, 1966, 1968, 1969, 1973) and empirical work (Katz & Norris,

1972; Katz, Norris, & Kirsh, 1969; Norris, 1977; Norris & Chapman, 1976, Norris & Cochran, 1977) was completed as part of the system development process.

SIGI has been effective in increasing career preparedness (Neumann, 1978); encouraging career search behavior (Davis & Dickson, 1980); improving career decision making skills (Chapman, Katz, Norris, & Pears, 1977; Cochran, Hoffman, Strand, & Warren, 1977; Riesenberg, 1980); enhancing confidence in educational and vocational planning (Kapes, Borman, and Frazier, 1986; Tulley & Risser, 1976); improving attitude toward career planning and career exploration (Kapes, Borman, and Frazier, 1986); decreasing the level of undecidedness (Salters, 1984) and indecision (Kapes, Borman, and Frazier, 1986); providing valid career guidance services for students with a variety of learning styles (Pelsma, 1982), and stimulating students' perceived needs for follow-up career counseling (Sampson & Stripling, 1979). There have been mixed results in terms of the impact of SIGI on career maturity, with Pyle and Stripling (1976) showing an increase while Devine (1975) and Fadden (1983) showing no improvement. In addition, Lotterhos (1980) found that SIGI did not significantly contribute to community college student persistence or academic achievement.

A new version of SIGI entitled "SIGI PLUS" was designed under the leadership of Lila Norris at the Educational Testing Service, with development beginning in 1980 and the first production version released in 1985. The new system was developed in response to comments from users and counselors concerning the effectiveness of SIGI with a diverse group of individuals, especially adults. Like SIGI, SIGI PLUS is designed to facilitate rational career decision making. In comparison with SIGI, SIGI PLUS: 1) provides greater diversity of self-assessment options, 2) is more flexible in terms of user control of system functioning, 3) provides specific content material related to the needs of typical adult learners as well as traditional college-age students, 4) includes content related to the job search process, 5) provides for easier customization of local data, and 6) makes use of color graphics. SIGI PLUS has nine sections that include: INTRODUCTION, SELF-ASSESSMENT, SEARCH, INFORMATION, SKILLS, PREPARING, COPING, DECIDING, and NEXT STEPS. Katz (1984) provided a description of the initial design of the system. The basic assumptions and design features of the system are described by Norris, Shatkin, Schott, & Bennett (1985).

Field test data reported by Norris, Shatkin, Schott, & Bennett (1986, p. 49) indicated that users found the system, "interesting, useful, and free from bias, its information plentiful and easy to use, and its writing style and vocabulary appropriate." Seeger (1988) found that use of SIGI PLUS resulted in improvement in college students' career development attitudes and knowledge. Hafer (1987) reported that SIGI PLUS was effective in reducing college students' career indecision. Buglione and DeVito (1986) found SIGI PLUS users to be

overwhelmingly positive in their perceptions of system effectiveness. Rogers (1984) reported that expert judges in adult learning and CACG, career guidance practitioners, and adults in career transition rated the design features of the Next Steps section of SIGI PLUS as theoretically consistent in terms of adult development and CACG.

Evidence currently exists as to the effectiveness of SIGI in relation to a variety of career development outcome measures. While preliminary data does exist as to the effectiveness of SIGI PLUS, it is not clear at present if this new system has a similar impact or performs as effectively as the preceding version.

## Purpose of the Study

The purpose of this study is to demonstrate a methodology for analyzing the performance of two versions of a CACG system that can be used with a wide variety of computer applications in career guidance and to provide specific data on the comparative impact of SIGI and SIGI PLUS.

## Methodology

### Sample

Sixty-four students from an introductory psychology class expressing interest in an experiment that involved receiving career guidance services participated in the study. All students received partial course credit for participating in the study. Table 1 contains a summary of student demographic data for each treatment condition. The mean age of students was 18.8 years (SD=1.7) with 75.0% being female and 67.2% white, 15.6% black, 12.5% Native American, 4.7% Asian American. The majority of students were freshmen (59.4%) and the three most popular declared majors were business (39.1%), psychology (9.4%), and clothing and textiles (6.3%); 10.9% were undecided majors. Some students reported prior career services experience: individual counseling, 21.9%; career course, 18.8%; and some type of CACG system, 14.1%. It was assumed that the sample sufficiently approximated typical students served in a college career center in order to permit a reasonable degree of external generalizability of the results. This was based on the fact that: (1) the study was described to potential subjects as involving career guidance services, (2) students in this study freely elected this particular experiment among numerous alternatives, (3) the demographic characteristics of the sample were very similar to actual career center clientele, and (4) about 15 students referred friends, roommates, etc. to the career center during the study.

### Instrumentation

The four types of instruments used in this study included: 1) general measures of career development; 2) specific measures of students' perceptions of the use of SIGI and SIGI PLUS;

3) measures used to verify the nature of the experimental treatment; and 4) an instrument for collecting demographic data.

The Occupational Alternatives Question (OAQ) (Zener & Schnuelle, 1972; modified by Slaney, 1978; 1980) measures level of career decidedness. Test-retest reliability for the OAQ was reported at .93 (Redmond, 1973) and found to be stable over a six week period (Slaney, 1978). Concurrent validity was demonstrated by Slaney, Stafford, and Russell (1981).

My Vocational Situation (MVS) (Holland, Daiger, & Power, 1980a) measures vocational identity, the perceived need for information, and perceived barriers to career decision making. Holland, Daiger, and Power (1980b) presented scale reliabilities (KR 20) ranging from .23 to .86, with the Identity Scale demonstrating the highest degree of internal consistency. Construct validity for the MVS was demonstrated by Holland, Daiger, and Power (1980b).

The SIGI and SIGI PLUS Evaluation Forms (Peterson, Sampson & Reardon, 1984) (see Appendix A). These two instruments are identical with the exception that the name SIGI or SIGI PLUS was used throughout each respective instrument. Each instrument had 3 scales; one scale measuring the effectiveness of the computer in helping the user to become familiar with oneself and the world of work (Analysis); one scale measuring the effectiveness of the CACGS in developing and evaluating career options (Synthesis); and one scale measuring global impressions and human factors (user friendliness) dimensions (Computer Effect). The intercorrelations among the three scales ranged from .39 to .60 while the respective alpha reliabilities were Analysis .83; Synthesis, .77; and Computer Effect, .87 (Peterson, Ryan-Jones, Sampson, Reardon, & Shahnasarian, 1987).

The Comparative Computer Rating Form (Reardon, Peterson & Sampson, 1985) (see Appendix B) contained items identical to the SIGI and SIGI PLUS Evaluation Forms, with the exception that instead of rating the degree of student agreement with various statements about SIGI or SIGI PLUS, students indicated on a bi-polar 7-point scale whether SIGI or SIGI PLUS more accurately represented various statements, after they had used both systems.

The SIGI Progress Record, and the SIGI PLUS Progress Record (Reardon, 1984a) (see Appendices C & D) were designed to verify the extent to which SIGI and SIGI PLUS were actually used by students. Basic demographic data and information related to students' prior experience with career counseling services, including computer applications, were also collected (Reardon, 1984b) (see Appendix E).

**Procedures**

The 64 students were randomly assigned to first use either SIGI (Educational Testing Service, 1984) (n=32), or SIGI PLUS (Educational Testing Service, 1985b) (n=32) and then use the

other system ten days later. The study was conducted at a university career resource center. Students in the SIGI and SIGI PLUS groups were encouraged to use supplemental print-based and audio-visual career information materials as part of the treatment and were asked not to use other available CACG systems in the center until the data collection was completed. Students using SIGI were asked to complete all five subsystems, while students using SIGI PLUS were instructed to complete specific sections according to their individual needs. Using the systems in this manner reflected recommendations for client use presented in the Counselor's Handbook for SIGI on Microcomputer (Chapman & Seibel, 1982) and the SIGI PLUS Counselor's Manual (Educational Testing Service, 1985a).

All students attended a group specific orientation meeting (see Appendix F) where: 1) an overview of the study was provided; 2) a research participation release form (see Appendix G), a demographic questionnaire, the OAQ and the MVS were completed; 3) an introduction to the purpose, operation, and procedures associated with SIGI or SIGI PLUS was provided; 4) an explanation of data collection procedures was presented; 5) initial appointments were scheduled for SIGI or SIGI PLUS, and 6) a tour of the career resource center, including the location of relevant resources, was completed. Both groups were encouraged to ask questions, obtain feedback, and seek support from available staff members during the study. All students completed SIGI or SIGI PLUS within a 10 day period at which time the following instruments were completed: 1) MVS; 2) OAQ; 3) SIGI Evaluation Form or SIGI PLUS Evaluation Form; and 4) SIGI Progress Record or SIGI PLUS Progress Record. Students then scheduled their use of the second system and completed the second system within a 10 day period. The Comparative Computer Rating Form was completed at a follow-up session, and a debriefing of the purpose of the study was then provided to all students.

**Data Coding and Analysis**

For data analysis, the OAQ score values were recoded (1) low and (2) high career decidedness based on the median split of the scores of the students. High career decidedness included those individuals who indicated either a first choice only or a first choice plus alternatives. Low career decidedness included students who listed alternatives, but no first choice, as well as those who had neither a first choice nor alternatives.

Students' scores on the Vocational Identity subscale of My Vocational Situation were divided into two levels of vocational identity based on the median split of the current sample. Thus students scoring nine or less were regarded as having low vocational identity (1), and those scoring ten to eighteen points had high vocational identity (2).

The sum of the "N" responses to the four items on the Information Needs subscale (MVSIN) of the My Vocational Situation provided an index of students' expressed information needs. For

analyses, students were divided into those who (1) expressed no need for information, and (2) those who expressed current needs for information. Similarly, the Barriers subscale of the MVS (MVSBAR), provided an index of students' perceived barriers in obtaining their career goals. Students were split into two groups, those with (1) no barriers, and (2) those who faced barriers to accomplishing their goals. Students' year in school (YEAR) was obtained from the demographic questionnaire and recoded for analysis into (1) Freshman, or (2) Sophomore, Junior, Senior, or Special Student (adults not enrolled full time).

A multivariate analysis of variance (MANOVA) using Wilk's lambda criterion was planned to examine the effects of treatment on students' perceptions of the CACG system used. The client attributes of career decidedness, vocational identity, information needs, and barriers were measured by the OAQ and the MVS. Year in school was also examined in the analyses on the dependent variables of Analysis, Synthesis, and Effect. For statistically significant findings, post hoc analyses involved the use of univariate ANOVAs.

Students' responses to the Comparative Computer Rating Form were analyzed according to the functions of Analysis, Synthesis, and Effect. Examination of individual items was planned to obtain a better understanding of the students comparison of SIGI and SIGI PLUS. Single-sample t-tests were used to determine if differences in users' preference for a particular CACG system were significant. Finally, a large-sample binomial probability test was planned to determine if the students' choice of a single preferred CACG system was significant. For all analyses, alpha was set at .05.

## Results

### Intercorrelation Matrix and the Effects of Time in Treatment

Table 2 presents the zero order correlations among the variables in this study. For these 64 students, initial vocational identity (MVSID1) and information needs (MVSIN1) were negatively correlated, as were post-treatment vocational identity (MVSID2) and information needs (MVSIN2). Thus as students' vocational identity scores increased, their information needs decreased. For all measures of student attributes, (OAQ, MVSID, MVSIN, MVSBAR), students' pre- and post-treatment scores were positively correlated, demonstrating relative stability over the 10 day period, despite the intervening CACGS treatment. There was a negative correlation between post-treatment vocational identity (MVSID2) and post-treatment perceived barriers (MVSBAR2), and a positive correlation between post-treatment barriers (MVSBAR2) and information needs (MVSIN2), but the same relationship did not exist prior to treatment. After using a single CACG system, students' higher vocational identity was related to decreased barriers, and decreased barriers were, oddly enough, positively correlated to increased information needs. Intercorrelations with the Comparative Computer Rating Form

dependent variables, (CAN, CSYN, CEF, and PREFSYS), are less interpretable.

The time spent using the first CACGS (TIME1) was positively correlated to time spent on the second CACGS (TIME2), implying that students who spent more time using the first system, also spent more time using the second CACGS. Students who used SIGI initially spent significantly more time using the system than those using SIGI PLUS [$F(1,59)=6.33$, $p=.01$]. The amount of time spent using a CACG system was not related to the client attribute variables of career decidedness, vocational identity, information needs, or perceived barriers.

**Evaluation of SIGI and SIGI PLUS**

The results of a multivariate analysis of variance with the three dependent variables, Analysis, Synthesis, and Effect, found no significant differences ($p=.52$) between the CACG systems (see Table 3). Users rated SIGI and SIGI PLUS equally positive for their effectiveness in obtaining self and occupational information (Analysis), viable career options (Synthesis), and in attractiveness of interacting with the computer (Effect).

In order to ascertain whether the effectiveness of the CACG system was a function of the students' level of career decidedness (OAQ), vocational identity (MVSID), information needs (MVSIN), perceived barriers (MVSBAR), or year in school (YEAR), a series of 2 X 2 (treatment X level of attribute) MANOVAs using high and low levels of the various attributes were performed. There were no main effects nor interaction effects of YEAR, OAQ, MVS-Identity or MVS-Barriers on the three dependent variables of Analysis, Synthesis, or Effect. However, the MANOVA indicated a significant main effect of MVS-Information Needs, which was further investigated using a 2 X 2 ANOVA. Students with high initial information needs rated both CACG systems significantly higher ($p < .05$) on the Analysis scale than those without initial information needs. (see Table 4, Figure 1). Students with information needs found both SIGI and SIGI PLUS more effective in helping them to obtain information about themselves and the world of work than did persons without needs for information.

Students' level of vocational identity (MVSID) increased significantly [$F(1,61)=7.95$; $p=.006$] as a result of using SIGI and SIGI PLUS (Table 6). Examination of the pre- and post-CACG treatment cell means on the MVS-Identity subscale across the two CACG systems shows that while both systems resulted in higher identity scores, SIGI PLUS users showed a greater increase in raw scores (SIGI: +.68; SIGI PLUS: +2.13), and less variability among users (see Table 5). On both systems, students with initial high levels tended to retain a high level of vocational identity after using a CACG system. Students with an initial low vocational identity score were more likely to increase their vocational identity score if they used SIGI PLUS, than if they used SIGI (see Table 6).

Repeated measures MANOVA indicated a significant change in students' information needs (MVSIN) as a result of using the CACG systems [F(1,60)=8.88, p=.004] (Table 7). Inspection of cell means (see Table 5) shows that users of both SIGI and SIGI PLUS decreased their raw score on need for information (MVSIN) as a result of using the CACGS (SIGI: -.51; SIGI PLUS: -.74). Table 7 shows the distribution of students on pre- and post-treatment MVS-Information Needs subscale by the CACG system used. SIGI and SIGI PLUS appear equally capable of satisfying users' needs for information.

The students' level of career decidedness (OAQ) did not change significantly as a result of using the CACG systems. Likewise, there was no significant pre-post change in the number of perceived barriers (MVSBAR).

**Comparison of SIGI and SIGI PLUS**

After using both CACG systems, students compared the two systems on the Comparative Computer Rating Form, rating their effectiveness on the Analysis, Synthesis, and Effect functions of CACGS. Single sample t-tests were used as a conservative measure to determine if the preference for either system was statistically significant. The students found SIGI and SIGI PLUS equally helpful for obtaining information about themselves and the world of work (CAN: mean=-.04, SD=.87, t=-.001, p>.05). The students felt that SIGI and SIGI PLUS were equally effective in suggesting viable career options (CSYN: mean=.05, SD=1.18, t=-.003, p>.05). The students rated SIGI and SIGI PLUS similarly on the attractiveness of using the computer (Effect) (CEF: mean=.08, SD=1.05, t=-.0008, p>.05).

The final item on the Comparative Computer Rating Form asked the students to indicate which system they would prefer if forced to make a choice. Of the 63 students who responded after using both CACG systems, 24 or 38% preferred SIGI, while 39 or 62% preferred SIGI PLUS. A large sample binomial probability test indicated that while the majority of student preferred SIGI PLUS overall, the significance was not at the .05 level (z=.19, p=.06). However, we can be 94% confident that users in this study, who experienced both CACG systems, preferred SIGI PLUS to SIGI. Table 8 contains the means and standard deviation of students' responses to each item on the Comparative Computer Rating Form.

The impact of students' initial career attributes on their preference for either SIGI or SIGI PLUS for the Analysis, Synthesis and Effect functions was examined through a series of one-way ANOVAs. Pre-treatment levels of career decidedness, vocational identity, information needs, perceived barriers, and the students' year in school had no significant impact on their rating of the two CACG systems.

Similarly, the impact of students' levels of career attributes subsequent to their first CACGs treatment, was

examined. Students with perceived barriers (MVSBAR2) after their use of either SIGI or SIGI PLUS indicated a significantly higher rating for SIGI in helping them to obtain and consider viable career options (Synthesis) [F(1,57)=4.79, p=.03] (see Table 9).

Neither pre- nor post-treatment levels of career decidedness, vocational identity, information needs, perceived barriers, nor year in school had any significant impact on students' final choice (PREFSYS) between SIGI and SIGI PLUS.

## Discussion

### Differential Impact of SIGI and SIGI PLUS

The use of SIGI PLUS resulted in greater gains in vocational identity, especially for those persons with low pre-treatment identity scores. Users of both systems also tended to express an overall preference for SIGI PLUS over SIGI. These findings suggest that the changes in system content and process in the evolution from SIGI to SIGI PLUS had a direct impact on system effectiveness. In particular, making the system more inclusive in the assessment options and information available (content) and more flexible and user friendly in terms of color displays, layering of information, and improved graphics (process) has resulted in improved system effectiveness.

The amount of time a person spends using a CACG system appears to be affected by the characteristics of both the individual and the system. Individuals who were very thorough in their use of one system demonstrated similar behavior with the second system used. Persons spent more time using SIGI than SIGI PLUS, indicating that the flexibility (user control of system functioning) incorporated into SIGI PLUS resulted in lower mean time on the system. This is an important finding in terms of cost-effectiveness. It appears that SIGI PLUS is more cost-effective than SIGI because more persons would tend use SIGI PLUS in a given period of time in comparison to SIGI, and because SIGI PLUS was more effective than SIGI in improving individuals' vocational identity.

In this study, SIGI and SIGI PLUS were equally effective in assisting individuals in obtaining needed information, as shown by MVSIN scores. Individuals perceived SIGI and SIGI PLUS as equally effective in: 1) helping them increase self and occupational information, 2) developing and evaluating career options, and 3) ease of system use. This would imply that the changes in system content and process in the evolution from SIGI to SIGI PLUS had no appreciable impact on these specific outcomes.

Finally, additional support for Holland's theory of vocational choice (Holland, 1985) is provided by virtue of the negative correlations between: 1) vocational identity, and 2) need for information and barriers, e.g. as both the need for

information and the indications of barriers decreased, vocational identity increased.

**Equivalence of CACG Systems**

Data from this particular study indicate that it is not appropriate to make generalizations about the equivalence of different versions of a CACG system when substantial content and process changes have been made. For example, SIGI PLUS cannot be considered equivalent to the original SIGI system in view of the results obtained in this study. This lack of equivalence is a function of differences in system content (expanded self-assessment options, material for adults, and job search information) and system process (flexibility and user friendliness).

## Implications for Practice

It would appear that the client perceived need for information is a valid prescreening variable for identifying individuals who are most likely to be appropriate users of a CACG system. Also, in evaluating a CACG system that has evolved substantially over time, practitioners need to be careful in making assumptions that the validity of the prior system version transfers to a revised version. Features that were or were not effective in one version of a CACG system may not be retained in revised versions. In situations where CACG system content or process changes have occurred, practitioners need to evaluate the issue of equivalency either through existing research, or at a minimum, conducting a thorough comparison of system features.

## Implications for System Design

System developers need to pay particular attention to the breadth of content included in CACG systems. Many individuals seeking career guidance have a specific need for information and a CACG system with a diversity of information available will be more likely to meet individual needs. Paying close attention to flexibility and user friendliness is also important in helping users obtain full benefit from the information included in a CACG system. Developers also need to fully explain and document the scope and purpose of system changes leading to revised versions when they are first introduced. Preliminary comparative studies between new and old versions should be reported prior to introducing new software. This will help all users make better transitions to revised versions of CACG systems. New system versions also require new training and marketing efforts by developers.

## Implications for Future Research

The amount of time an individual spends using a CACG system appears to be influenced by both individual and CACG system characteristics. The undergraduate students in this study spent less time using SIGI PLUS compared to SIGI, but adult career

changers might be expected to spend more time using SIGI PLUS. This might occur both because of user characteristics and changes intentionally designed into SIGI PLUS. It would be important to more fully understand the impact of the amount of time spent using a CACG system on various career guidance outcomes. It would also be important to replicate the system comparison methodology used in this study with different user groups and different system versions in order to further validate this approach for determining the equivalency of different versions of a CACG system.

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Table 1
Group and Aggregate Demographic Characteristics of the Sample

| Characteristic | Percentage | Mean | Standard Deviation |
|---|---|---|---|
| Age | | 18.8 | 1.7 |
| Freshmen | 59.4% | | |
| Males | 25.0% | | |
| Females | 75.0% | | |
| White | 67.2% | | |
| Native American | 12.5% | | |
| Black | 15.6% | | |
| Asian | 4.7% | | |
| Business Majors | 39.1% | | |
| Psychology | 9.4% | | |
| Clothing & Textile | 6.3% | | |
| Undecided | 10.9% | | |
| Individual Counseling | 21.9% | | |
| Career Course | 18.8% | | |
| CACG System | 14.1% | | |

Table 2
Intercorrelation Matrix (n=64)

| Variables | Correlations 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Analysis | - | | | | | | | | | | | | | | | | | |
| 2. Synthesis | .40*** | - | | | | | | | | | | | | | | | | |
| 3. Effect | .58*** | .69*** | - | | | | | | | | | | | | | | | |
| 4. Year[a] | -.07 | -.11 | -.20 | - | | | | | | | | | | | | | | |
| 5. Time1[b] | .08 | -.15 | .05 | .16 | - | | | | | | | | | | | | | |
| 6. OAQ1[c] | .04 | .09 | .08 | -.14 | -.10 | - | | | | | | | | | | | | |
| 7. MVSID1[d] | .02 | -.08 | -.08 | .13 | -.11 | .10 | - | | | | | | | | | | | |
| 8. MVSIN1[e] | .21 | -.21 | .02 | -.08 | .14 | .18 | -.24* | - | | | | | | | | | | |
| 9. MVSBAR1[f] | -.15 | -.04 | -.14 | .07 | .17 | .00 | -.08 | -.07 | - | | | | | | | | | |
| 10.OAQ2[b] | -.06 | .10 | .15 | -.18 | -.26* | .42*** | .15 | .13 | -.02 | - | | | | | | | | |
| 11.MVSID2[c] | -.02 | .13 | .18 | .05 | -.35** | .15 | .58*** | -.31** | -.23* | .37*** | - | | | | | | | |
| 12.MVSIN2[d] | .28* | .05 | -.07 | -.05 | .21 | .05 | -.34** | .47*** | .05 | -.11 | -.50*** | - | | | | | | |
| 13.MVSBAR2[e] | -.06 | -.02 | -.21 | -.02 | .20 | .07 | -.11 | .05 | .62*** | .01 | -.32 | .24* | - | | | | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14.Time2[b] | .16 | .04 | .14 | .09 | .25* | .14 | .13 | -.00 | .21 | .11 | .09 | -.03 | .21 | - | |
| 15.PREFSYS[g] | .00 | -.13 | -.04 | -.01 | -.02 | -.09 | -.01 | .09 | -.14 | .10 | -.06 | .04 | -.14 | -.13 | - |
| 16.Comp.-Analysis | -.08 | -.21 | -.10 | -.20 | -.09 | -.01 | -.10 | .22* | -.03 | .16 | -.17 | .10 | -.00 | -.32** | .66*** - |
| 17.Comp.-Synthesis | -.15 | -.22* | -.05 | .00 | .10 | -.14 | -.13 | .14 | -.18 | .08 | -.03 | .06 | -.28* | -.18 | .78***.67*** - |
| 18.Comp.-Effect | -.20 | -.26* | -.08 | .09 | .09 | -.13 | -.05 | .13 | -.02 | .08 | -.10 | .08 | .01 | -.15 | .69***.65***.74*** - |

[a] Year in school(1=Freshman, 2=Sophomore, Jumnior, Senior, Special Student)
[b] Time on CACG system (1= less than 100 minutes, 2=more than 100 minuts)
[c] Occupational Alternatives Questionnaire Scale (1=first choice only or first choice plus alternatives, 2=alternatives only nor alternatives)
[d] My Vocational Situation - Identity Scale (1=low identity, 2=high identity)
[e] My Vocational Situation - Information Needs Score (1=no information needs, 2=need information)
[f] My Vocational Situation - Barriers Scale (1=no barriers, 2=barriers)

Table 3
MANOVA Summary Table

| | SIGI (n=30) M | SD | SIGI PLUS (n=31) M | SD | F(1,60) | Sign. of F |
|---|---|---|---|---|---|---|
| Dependent Variables | | | | | | |
| Analysis[a] | .74 | .50 | .77 | .53 | .04 | .84 |
| Synthesis[a] | .40 | .82 | .74 | .55 | 3.07 | .06 |
| Effect[a] | .37 | .66 | .48 | .54 | .47 | .50 |

Multivariate Tests of Significance

| Test Name | Value | F | DF | Error DF | Sign. of F |
|---|---|---|---|---|---|
| Pillais | .04 | .76 | 3.0 | 54.0 | .52 |
| Hotellings | .04 | .76 | 3.0 | 54.0 | .52 |
| Wilk's | .10 | .76 | 3.0 | 54.0 | .52 |
| Roys | .04 | | | | .52 |

[a] Scoring: 5-point Likert-type scale, where -2 = strongly disagree; -1 = disagree; 0 = neutral; +1 =agree; +2 = strongly agree

Table 4
Comparison of the Analysis Function According to CACG Systems with My Vocational Situation Information Needs Scale as Moderator Variable

| MVSIN | Systems: SIGI M[a] | SIGI SD | SIGI PLUS M | SIGI PLUS SD |
|---|---|---|---|---|
| HIGH | .84 (n=16) | .43 | .97 (n=16) | .44 |
| LOW | .68 (n=12) | .58 | .57 (n=13) | .60 |

Wilk's Lambda Multivariate Tests of Significance

| Test Name | Value | F | DF | Error DF | Sign. of F |
|---|---|---|---|---|---|
| CACG System | .96 | .73 | 3.0 | 51.0 | .54 |
| MVSIN | .82 | 3.76 | 3.0 | 51.0 | .02* |
| System X MVSIN | .97 | .45 | 3.0 | 51.0 | .72 |

Univariate Source Table

| Source of Variation | SS | MS | DF | F | Sign. of F |
|---|---|---|---|---|---|
| Main Effects | 1.10 | .55 | 2 | 2.11 | .13 |
| System | .00 | .00 | 1 | .03 | .86 |
| MVSIN | 1.10 | 1.10 | 1 | 4.20 | .05* |
| System X MVSIN | .21 | .21 | 1 | .81 | .37 |
| Explained | 1.31 | .44 | 3 | 1.67 | .18* |
| Residual | 13.86 | .26 | 53 | | |

[a] On a 5-point Likert-type scale scored as follows: -2 = strongly disagree, -1 = disagree, 0 = neutral, +1 = agree, and +2 = strongly agree.

* $p < .05$

Table 5
Raw Score Mean Comparison of Client Attributes Pre- and Post-Treatment across CACG Systems

| Client Attributes | SIGI M | SIGI SD | SIGI PLUS M | SIGI PLUS SD | Combined Systems M | Combined Systems SD |
|---|---|---|---|---|---|---|
| OAQ1[a] | 2.41 | .68 | 2.31 | .47 | 2.36 | .58 |
| OAQ2 | 2.38 | .49 | 2.16 | .45 | 2.26 | .48 |
| | (n=29) | | (n=32) | | (n=61) | |
| MVSID1[b] | 9.16 | 4.74 | 9.78 | 4.72 | 9.48 | 4.70 |
| MVSID2 | 9.84 | 5.32 | 11.91 | 4.16 | 10.89 | 4.84 |
| | (n=31) | | (n=31) | | (n=62) | |
| MVSIN1[c] | .55 | .89 | .58 | .76 | .56 | .82 |
| MVSIN2 | 1.06 | 1.18 | 1.32 | 1.33 | 1.19 | 1.25 |
| | (n=31) | | (n=31) | | (n=62) | |
| MVSBAR1[d] | 3.42 | .88 | 3.58 | .67 | 3.50 | .78 |
| MVSBAR2 | 3.29 | .94 | 3.58 | .72 | 3.44 | .84 |
| | (n=31) | | (n=31) | | (n=62) | |

"1" following the client attribute refers to pre-treatment data.
"2" following the client attribute refers to post-treatment data.

[a] Scoring: 1= first choice only, no alternatives; 2= first choice with alternatives; 3= no first choice, alternatives only; 4= neither first nor alternatives.

[b] Scoring: total number of "false" responses on the Vocational Identity subscale of the MVS.

[c] Scoring: total number of "no" responses on the Information Needs subscale of the MVS.

[d] Scoring: total number of responses on the Barriers subscale of the MVS.

Table 6
Repeated MANOVA Summary Table - Change in Vocational Identity as a result of using the CACGS.

| | SIGI MVSID2 | | | | SIGI PLUS MVSID2 | | |
|---|---|---|---|---|---|---|---|
| | HI | LO | | | HI | LO | |
| MVSID1 HI | n=15 | n=0 | 15 | MVSID1 HI | n=14 | n=2 | 16 |
| MVSID1 LO | n=3 | n=13 | 16 | MVSID1 LO | n=9 | n=6 | 15 |
| | 18 | 13 | 31 | | 23 | 8 | 31 |

Repeated Multivariate Source Table

| Source | SS | DF | MS | F | Sign of F |
|---|---|---|---|---|---|
| Within Cells | 23.17 | 61.0 | .38 | | |
| System | .37 | 1.0 | .37 | .97 | .33 |
| Within Cells | 6.09 | 61.0 | .10 | | |
| Trial[a] | .79 | 1.0 | .79 | 7.95 | .00** |
| System X Trial | .12 | 1.0 | .12 | 1.17 | .28 |
| Total | 7.00 | 63.0 | .11 | | |

[a] Trail is the change between pre- and post treatment MVS-Vocational Identity

** $p < .01$

Table 7
Repeated MANOVA Summary Table - Change in Information Needs as a result of using the CACGS.

| | SIGI MVSIN2 | | | SIGI PLUS MVSIN2 | | |
|---|---|---|---|---|---|---|
| | HI | LO | | HI | LO | |
| MVSIN1 HI | n=12 | n=7 | 19 | n=11 | n=7 | 18 |
| MVSIN1 LO | n=2 | n=10 | 12 | n=2 | n=11 | 13 |
| | 14 | 17 | 31 | 13 | 18 | 31 |

Repeated Multivariate Source Table

| Source | SS | DF | MS | F | Sign of F |
|---|---|---|---|---|---|
| Within Cells | 21.97 | 60.0 | .37 | | |
| System | .03 | 1.0 | .03 | .09 | .77 |
| Within Cells | 7.84 | 60.0 | .13 | | |
| Trial[a] | 1.16 | 1.0 | 1.16 | 8.89 | .00** |
| System X Trial | 0 | 1.0 | 0 | 0 | 1.00 |
| Total | 9.00 | 62.0 | .15 | | |

[a] Trial is the change between pre- and post-treatment MVS-Information Needs

** $p < .01$

Table 8
Means and Standard Deviations of items on Comparative Computer Rating Form

**COMPARATIVE COMPUTER RATING FORM**
by
Gary W. Peterson, Ph.D., Rebecca E. Ryan-Jones, M.Ed.,
James P. Sampson, Jr., Ph.D. and Robert C. Reardon, Ph.D.

Directions: Listed below are items which contain the word pairs SIGI and SIGI+ at either end of the scale and seven spaces between the pairs. Please rate SIGI and SIGI PLUS on each item according to the following guideline.

SIGI_____:_____:_____:_____:_____:_____:_____SIGI+

| Very Strongly SIGI | Quite Strongly SIGI | Only Slightly SIGI | Equally SIGI & SIGI+ | Only Slightly SIGI+ | Quite Strongly SIGI + | Very Strongly SIGI+ |
|---|---|---|---|---|---|---|

| | | |
|---|---|---|
| 1. The computer helped me to learn much more about several occupations. (A) | SIGI : : : .05: : : SIGI+ | SD 1.7 |
| 2. The computer was helpful in showing me whether I needed more information about occupations before making career decisions. (A) | SIGI : : : :.14: : SIGI+ | SD 1.7 |
| 3. Using the computer was like talking to a career counselor. (E) | SIGI : : :-.03: : : SIGI+ | SD 1.1 |
| 4. The computer presented logical career options given my values, interests, and abilities. (S) | SIGI : :-.34: : : : SIGI+ | SD 1.5 |
| 5. The computer helped me to understand the rewards potential occupations offer, such as salary, interesting work, prestige, variety, and challenge. (A) | SIGI : :-.14: : : : SIGI+ | SD 1.9 |
| 6. I felt the computer understood my career problems. (E) | SIGI : :-.14: : : : SIGI+ | SD 1.0 |
| 7. I have learned about some new educational programs as a result of using the computer. (E) | SIGI : : : .08: : : SIGI+ | SD 1.1 |
| 8. The computer helped me feel confident that I would find most of the final list of potential occupations satisfying. (S) | SIGI : : : .06: : : SIGI+ | SD 1.5 |

SIGI_____:_____:_____:_____:_____:_____:_____SIGI+

| Very | Quite | Only | Equally | Only | Quite | Very |
|---|---|---|---|---|---|---|

| Strongly SIGI | Strongly SIGI | Slightly SIGI | SIGI & SIGI+ | Slightly SIGI+ | Strongly SIGI + | Strongly SIGI+ |
|---|---|---|---|---|---|---|

9. The computer satisfied me with the variety of career options it gave me to consider. (S)

SIGI : : : : .11: : SIGI+ SD 1.8

10. The computer helped me to become more familiar with the educational requirements of potential occupational choices. (A)

SIGI : : : : .40: : SIGI+ SD 1.6

11. The computer was helpful in accurately clarifying my values. (A)

SIGI : :-.89: : : : SIGI+ SD 1.8

12. The computer helped me to feel more hopeful of finding a satisfying occupation. (E)

SIGI : : : : .31: : SIGI+ SD 1.6

13. I can seriously consider most of the occupations the computer suggested. (S)

SIGI : : : .00: : : SIGI+ SD 1.4

14. My family or friends would like the outcomes suggested by the computer. (E)

SIGI : : :-.03: : : SIGI+ SD 1.2

15. The computer satisfied me with the number of career options it gave me to consider. (S)

SIGI : : : .02: : : SIGI+ SD 1.7

16. The computer was helpful in accurately clarifying my interests. (A)

SIGI : :-.21: : : : SIGI+ SD 1.7

17. The computer was helpful in showing me whether I needed more information about myself before making career decisions. (A)

SIGI : :-.14: : : : SIGI+ SD 1.7

18. The computer helped me understand the demands associated with potential occupational choices, such as amount of free time, vacations, and continuing education. (A)

SIGI : :-.44: : : : SIGI+ SD 1.7

| SIGI | : | : | : | : | : | SIGI+ |
|---|---|---|---|---|---|---|
| Very Strongly SIGI | Quite Strongly SIGI | Only Slightly SIGI | Equally SIGI & SIGI+ | Only Slightly SIGI+ | Quite Strongly SIGI + | Very Strongly SIGI+ |

| | | | |
|---|---|---|---|
| 19. The computer answered most of my career questions to my satisfaction. (E) | SIGI : : : : .26: : SIGI+ | SD | 1.5 |
| 20. The computer helped me to identify important milestones to achieve in attaining a career, such as educational degrees, training, or licenses. (A) | SIGI : : : : .50: : SIGI+ | SD | 1.6 |
| 21. The computer helped me better understand how the world of work is organized. (A) | SIGI : : : : .23: : SIGI+ | SD | 1.0 |
| 22. I understand myself better now. (E) | SIGI : :-.11: : : : SIGI+ | SD | 1.3 |
| 23. I felt better about my career after I used the computer. | SIGI : : : : .30: : SIGI+ | SD | 1.6 |
| 24. The computer helped me become more confident of being able to choose a satisfying occupation. (E) | SIGI : : : : .13: : SIGI+ | SD | 1.7 |
| 25. If I had to make a choice, I would prefer (Circle either SIGI or SIGI+) [SIGI = 1; SIGI+ = 2]: | SIGI 1.6 SIGI+ | SD | 0.5 |

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Table 9
Impact of Perceived Barriers Subsequent to using the first CACG System on the Comparison of SIGI and SIGI PLUS on the Synthesis Function of the System.

| | | MVSBAR2 | |
|---|---|---|---|
| | | HIGH | LOW |
| Comparison on Synthesis | MEAN[a] | -.47 (n=22) | .21 (n=37) |

Univariate Source Table

| Source of Variation | SS | MS | DF | F | Sign. of F |
|---|---|---|---|---|---|
| Main Effects | 6.34 | 6.34 | 1 | 4.79 | .03* |
| MVSBAR | 6.34 | 6.34 | 1 | 4.79 | .03* |
| Explained | 6.34 | 6.34 | 1 | 4.79 | .03* |
| Residual | 75.44 | 1.32 | 57 | | |
| Total | 81.79 | 1.41 | 58 | | |

[a] On the Comparative Computer Rating Form, a negative number indicates a preference for SIGI, while a positive number indicates a preference for SIGI PLUS.

* $p < .05$